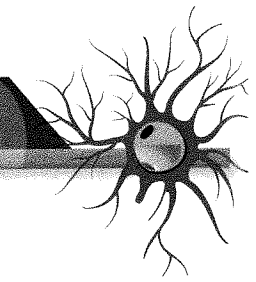

# The neuroscience of memory processes

For years, researchers have investigated the question of why counseling and psychotherapy work. Countless counseling theories, including common factors, unconditional positive regard, and corrective emotional experiences, have attempted to explain the whys and wherefores behind the magic of the therapy process. So, what are the unifying elements that connect these theories and ideas?

Neuroscience may provide a useful framework for understanding how and why therapeutic changes occur. In a 2015 article published in *Behavioral and Brain Sciences*, Richard Lane, Lee Ryan, Lynn Nadel and Leslie Greenberg proposed that the essential ingredients to therapeutic change include the reactivation of old memories, the updating of these memories via reconsolidation, and the reinforcement of the new memory structure with deliberate practice of new behaviors and experiences in a variety of contexts.

Counseling and psychotherapy inherently focus on emotions, thoughts and behaviors by accessing memory. At the core of most of what we talk about in counseling is memory — memories of past events, memories of our identities, memories of salient life experiences, and memories of intense feelings or reactions. It is important for counselors to be able to understand basic memory processes because of their integral role in the counseling process.

## Types of memory

The two main types of memory processes that predominate in counseling and psychotherapy are implicit and explicit memory. The main difference between these two memory types is the level of conscious awareness involved in the memory's recall. With explicit memory, we are aware that we are recalling a memory of a specific instance, event or fact. In contrast, implicit memory is largely unconscious, meaning we are not aware that the memory is being recalled when it is occurring. For example, implicit memory is you remembering how to ride a bike — how you need to keep your body weight centered while simultaneously (and automatically) adjusting your weight and balance, pedaling the wheels, and using the handlebars to steer. Explicit memory is remembering the day you learned to ride your bike. For instance, you may remember that it was a sunny day, the color of your bike, or that your parent was there to help you. This memory may play like a movie once you begin to recall the day.

Explicit memory largely involves the hippocampus, a region of the brain necessary for the creation and storage of new memories. The hippocampus is located in the medial or inner temporal lobes and helps bind together the memory of perceived objects along with the spatial and temporal contexts in which they occurred. The different sensory elements of memories, such as the visual, auditory and tactile components, are stored in different areas of the cortex, creating a memory circuit. One memory is not stored in a single location of the brain; rather, it is stored across many regions of the brain that all fire when you are recalling that memory.

Standard consolidation theory states that the hippocampus and related temporal lobe structures are required for the initial storage of the new memory and initial recalls of that memory. Over time, however, this activation will become less and less necessary as the connections between the cortical elements of the memory are strengthened and connected. Additionally, the frontal lobes also have been shown to be integral to memory storage, appearing to help bind additional contextual information related to the event memory. This allows us to record not only a specific event but also specific details about the event, such as when and where it took place.

Implicit memory is typically hard to communicate to others, whereas explicit memory tends to be communicated easily. Generally speaking, implicit learning and memory are occurring when you are not aware that you are either learning something or recalling a memory. Implicit memories are those that are hard to verbalize. They are the types of memories that are met with answers such as "I don't know" or "I just know how to do it." Implicit memories drive behavior and are a form of automatic information processing. The brain works to make information processing as quick and efficient as possible, which is why these types of memories happen below the level of awareness. The brain is constantly looking for patterns in sensory cues and outcomes. Many implicit memories can be viewed as neural outcomes of repeated performances or actions.

Like explicit memories, implicit memories are not stored in one location, nor is one brain region responsible for their storage. The cerebellum, cortex and basal ganglia are all key players in implicit memory. The cortex is mostly involved in controlling complex action sequences, whereas the basal ganglia are critical in pairing sensory cues and responses. The cerebellum is the time keeper, making sure that responses are timed appropriately.

All of this processing occurs below the level of conscious awareness, which is why when people try to make an implicit memory conscious, some things start to go out of whack. For example, if you play a sport of any kind, you learn to do certain things automatically to play it well. Usually, your brain takes care of a lot of this on its own. But if you are trying to modify how you play, such as changing the angle of your golf swing, or if something else such as nerves or anxiety interferes, you might notice that your performance on that particular task starts to falter. This is because the skill memory, which is a type of implicit memory, is being disrupted by your conscious awareness.

This is the key to starting to understand what we do as counselors: We make implicit and explicit memories conscious to help clients store the memories in a new, and usually more empowering, way.

This occurs through the memory processes of consolidation and reconsolidation.

### Memory processes

When an individual's sensory organs perceive and encode an event, a memory for that event is recorded. Following the experience of the event, the memory goes into a vulnerable state called the consolidation period, during which time new memories are easily lost or altered. It is important to note that when memories are stored, they are not immutable. They are affected by our perceptions of the event and the meaning that we make of the event; not all details of the event may be remembered accurately. Additionally, memories continuously go through revisions and changes as they age and are recalled. Each time a memory is recalled, details of it will change slightly.

After a memory is recalled, it will go through another round of consolidation, called reconsolidation. This will occur over and over again, each time that a memory is recalled. This highlights the constructive nature of memory; any memory, such as a perception or emotion, can be slightly altered and stored again in a new way.

Eric Kandel, a 2000 Nobel laureate for his studies of memory processes, states in his book *In Search of Memory: The Emergence of a New Science of Mind*, "For all of us, explicit memory makes it possible to leap across space and time and conjure up events and emotional states that have vanished into the past yet somehow continue to live on in our minds. But recalling memory episodically — no matter how important the memory — is not like simply turning to a photograph in an album. Recall of memory is a creative process. What the brain stores is thought to be only a core memory. Upon recall, this core memory is then elaborated upon and reconstructed, with subtractions, additions, elaborations, and distortions."

### Memory applications to the counseling process

Kandel's quote describes the power that counseling can have on an individual. Regardless of your theoretical orientation, memory processes play an important role in your work as a counselor.

If you practice using cognitive behavior therapy, memory processes are present when you help clients alter cognitive distortions and calm automatic emotional reactions. If you use narrative therapy, it is the changing of the client narrative — the deliberate process of helping the client see a different side of a situation or memory, allowing that memory to be stored in a different way, and having long-lasting effects on other memories and future encoding.

Counseling inherently involves learning and memory. A form of implicit learning is present when clients learn how to regulate an emotion and modify their reactions to it. Explicit learning is present when clients update a memory that has caused them to feel powerless and ashamed to something more empowering. When the memory starts to unconsciously affect the client's thoughts, feelings or behaviors, it turns into implicit learning.

It has been well-established through years of research that memories are best stored when they are able to be related to past memories or past knowledge. Therefore, when an event occurs in our clients' lives that confirms a memory that clients already know to be true about themselves, this new memory may be stored more readily than one that does

not have a previously existing memory, thus expanding the currently existing memory circuit.

This partially explains why it is so hard for clients to change previously held beliefs about themselves and the world around them. Some level of this belief exists in many of their memories up to this point and continues to have an impact on the storage of new memories. Change necessitates the repetitive recall and reactivation of old memories, in conjunction with changing the perspective, changing the cognitive distortion, changing the negative narrative and allowing those memories to be reconsolidated. Slowly but surely, these changed memories will start to have an impact on the ongoing formation of new memories. This is the beginning of the change process.

Additionally, many clients are not aware of the automatic processes that affect their behavior. These implicit response patterns fire automatically without coming into the awareness of the individual. Usually, this is based on a small set of sensory cues that elicit a response faster than conscious awareness would allow.

Many counselors may be familiar with a Jungian quote: "Until you make the unconscious conscious, it will direct your life and you will call it fate." There is some merit to this statement that communicates what we are doing as counselors, much like learning to change the angle of the golf swing mentioned earlier.

Bringing an implicit memory to consciousness creates an opportunity for it to be modified and stored again. It is important to note two reasons that not all implicit processes can be brought into conscious awareness: 1) They are not anatomically connected to regions of the brain that allow this access, and 2) they are not allowed access to awareness due to repression or denial.

## Implications for counselors

As previous sections have highlighted, memory processes have important implications for our work as counselors. The recall and reactivation of memories enable them to be reconsolidated with additional contextual and emotional information in a way that can change future thoughts, emotions and behaviors. Any change requires time and deliberate repetition — sometimes several months' worth of repetition.

Changing an implicit memory tends to be harder than modifying an explicit memory and generally requires more time. This speaks to the importance of treatment planning and homework outside of the counseling session. Because explicit memories are not only easier to access but also easier to modify, it is not surprising that this is where most counseling work resides.

Posttraumatic stress disorder (PTSD) provides an example to highlight memory processes in action in counseling. PTSD is a complex disorder with many components, one of which is a disconnection between implicit and explicit memory. When an individual experiences a traumatic event, a strong fear response leads to a high level of fear conditioning (implicit memory) by a brain region called the amygdala. The amygdala plays a key role in initiating the body's emotional responses and adding emotional content to memory. The strong fear conditioning created by this region is a response to a set of sensory cues related to the event.

For individuals with PTSD, however, the hippocampus (the area of the brain responsible for the creation of contextual information in memory) is structurally and functionally impaired because of high stress hormone levels or because of anatomical differences in the individuals. This reduced hippocampal influence creates triggers that are hard to distinguish from other similar sensory cues because of the lack of contextual information stored with the fear conditioning. Additionally, it has been shown that in individuals with PTSD, the medial and prefrontal cortices (which also add contextual information to memory) are underactive when confronted with triggering sensory cues. In other words, these individuals possess a strong implicit memory to be afraid of a particular set of sensory cues but no contextual information (explicit memory) of the event to mediate or diffuse their fear response.

What counseling can do for individuals seeking treatment for PTSD is twofold. It can 1) add contextual information to the fear memory to help diffuse the strong fear response cascade to triggers and 2) reduce the impact of the implicit fear trace by reactivating it in a safe context in the counseling session. This is what informs the goals we see in treatment manuals for PTSD regarding remembering details of the traumatic event. It involves adding explicit memory components to the implicit memory that resulted from the trauma to alleviate symptoms.

## Summary

Implicit and explicit memory processes are prominent forces in our lives and important to the counseling process. Explicit memories are memories that are consciously recalled, such as facts or events, and are easily modifiable through reconsolidation. These memories are initially encoded by the hippocampus and are stored in various regions throughout the cortex.

Implicit memories are a form of automatic information processing and involve the cerebellum, basal ganglia and cortex. Implicit memories also can change over time despite their unconscious nature, but they generally require more time and repetition and need to be brought into the explicit domain.

Past research on common factors to the therapeutic outcomes of counseling and psychotherapy has focused only scantly on elements of brain science to explain them. Understanding the role that neuroscience plays in our work as counselors not only provides a useful explanation for what we do but also offers a useful framework for future education, practice and theory to continue our growth as practitioners, change agents and educators. ❖

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